

**PLASTIC INJECTION PROCESS FOR THE MANUFACTURE OF A LID FOR AN
ELECTRIC CAPACITOR, AND THE PRODUCT OF SUCH PROCESS**

BACKGROUND OF THE INVENTION

The idea of a lid with two different materials that serves as cover, packing and safety valve to exhaust gas from a capacitor casing already exists. The form of manufacture, materials and design of the lid currently existing in the market are totally different and have existed for over 20 years. Current lids are manufactured through more than one process and result in a high amount of waste, making their manufacture very expensive compared to the new proposal. On the other hand, materials used in the lid currently existing in the market are not thermoplastic resins for injection and are of a much lower quality than those of the new proposal.

DETAILED DESCRIPTION OF THE INVENTION

This invention refers to a plastic lid that serves as top cover of a case for an electric capacitor and the manner in which it is manufactured.

PRODUCT:

The lid I propose has a better design which is entirely different to the already existing lid, that includes an edge (7) in the perimeter of the two parts (17) and (18) serves as mechanical grip to secure that both components are not

separated. In turn, the perimeter formed by the rubber serves as additional packing that helps to achieve better sealing when the lid is inserted in the case, which the current lid lacks. The seal is vitally important as it secures correct performance and the useful life of the capacitor.

Thermo-plastic resins which I use in my lid are entirely different and have a better quality than the material used in current lids, with the benefit of a higher resistance to the flame, which is extremely important, as it is an electric product. Materials used in my lid are UL-V2 certified (flame resistance certification), which current lids lack and is highly important for any electric product.

It has two orifices (14) and (15) passing through the lid from side to side; this is where the terminals of the capacitor are riveted. The rubber (18) also serves as packing when the terminals of the lid are riveted. It has a valve (16) formed with an orifice in the rigid part (17) and in the lower part it is covered with the rubber material (18) and acts as a valve (16) for exhaust of gas in case of overheating of the capacitor, which is achieved by breaking of the rubber material (18) in the part of the valve (16) because of pressure produced by gas that may result from overheating.

As thermoplastic materials are of a better quality and are entirely different to those used in lids currently existing in the market, this permits the gas exhaust valve (16) to secure that it breaks, always providing greater safety for the final user and thus avoid accidents.

The Capacitor Lid with the protection proposed consists of 2 parts, one rigid (17) and the other of rubber material (18), as well as 2 orifices (14) and (15) passing through the lid from side to side; this is where the terminals of the capacitor are riveted. The rubber (18) serves as packing of the riveted terminals, it also has a valve (16) formed with an orifice in the rigid part (17), and the lower part is covered with the rubber material (18) and acts as safety valve to exhaust gas from the capacitor through breaking of the rubber material (18) by pressure produced by gas that may cause overheating.

Additionally, this is a better design of the lid, that includes an edge (7) in the rigid part (17) and another in the flexible part (18), that serves as mechanical grip, so that when the rubber material part is injected (18), it adheres perfectly to the rigid part (17). This in turn, permits a packing to be formed with the rubber material (18) in the perimetric part of the piece (7), current lids lack

that perimetric packing, as they are not manufactured with a double injection machine with two molds that handle the manufacturing process in a single step. As to the lid with the protection proposed, it has better sealing, which is vital to secure no leakage of the dielectric and thus prolong the useful life of the capacitor. Contrary to materials used in lids existing in the market, the thermoplastic resins I use in my process have a V2 rating UL registration, and thus secure resistance to flame, a situation that is extremely important as it is an electric product.

PROCESS:

The process I propose in order to manufacture the lid is unique, as the lid currently offered in the market is manufactured in an entirely different manner that follows more than one process and produces a large amount of waste. This waste cannot be reused, as they are thermo-fixed materials and cannot be reprocessed. By using a double injection machine, we achieve a lid that is entirely finished in a single process, where the main benefit is a cheaper lid, although the thermoplastic resins are of a higher quality and more expensive than materials used in existing lids, due to savings achieved in the manufacturing processes.

There is an additional benefit, which is not having waste, as the pieces are manufactured in a single process and faulty parts may be reprocessed inasmuch as thermoplastic materials are being used. Additionally, this process offers improvements in the performance of the lid, as materials used in its manufacture, according to the novelty process, are of a higher quality than those used in lids currently existing in the market, which permits the gas exhaust valve (16) to always pop and thus secure greater safety for the final user by avoiding accidents and having better resistance against flame.

Because of the double injection process, contrary to already existing lids, we can create a perimetric seal (3) with the rubber material contour and thus achieve better sealing with the capacitor casing, avoiding leaks of the dielectric that capacitors carry inside, assuring better performance and a longer useful life of the capacitor.

DETAILED EXPLANATION OF THE PROCESS:

The process is achieved through the unique and exclusive design of two steel molds consisting of two halves each (24) + (12) and (36) + (13) in order to inject the two thermoplastic resins in a single step and at the same time.

A double injection machine (4) is required, where the halves of the two molds (24) and (36) are mounted on a fixed plate (5) and the two halves (12) and (13) on a rotating plate (6). The machine (4) has two injection units (1) and (2), one for each material injected. The rigid thermoplastic resin is processed in the injection unit (1), and the rubber material thermoplastic resin is processed in the injection unit (2).

The following are necessary to achieve injection of the lid with two thermoplastic materials:

- A double injection machine (4)
- The fixed part of the mold (24) that has the form of the rigid part of the lid (17) and the fixed part of the mold (36) that has the form of the rubber material part (18)
- The rotating part of the mold (12) and the rotating part of the mold (13). These parts of the molds are identical, but when the machine closes (12) and (13), they acquire the form of the lid which they will inject, depending on the side where they are located.

Rotation of the molds (12) and (13) making them acquire different forms according to the side where they are located, is achieved through a system adapted in the molds that

permits certain components of the molds to shift, either in a backward or forward position, thus forming the figure of the lid intended to inject. This system may be activated through mechanic, hydraulic or pneumatic systems.

The following is an explanation of how the molds work:

The parts of the molds (24) and (36) are mounted on the fixed plate (5) and the parts (12) and (13) are mounted on the rotating plate (6).

The different configurations of the molds when the machine closes may be:

- (24) + (12) or (13) = injects the rigid part of the lid (17)
- (36) + (12) or (13) = injects the rubber material part of the lid (18)

Once the rigid part of the lid (17) is injected, the machine (4) opens and the rotating plate (6) turns 180 degrees taking (12) or (13) to the fixed part of the mold (36) which has the form of the rubber material part of the lid (18) in order to be injected on (17), this is when injection of the lid is completed. The machine opens (4) and expels the finished lid, turns the rotating plate (6) 180 degrees in order to begin the process again.

DESCRIPTION OF THE DRAWINGS

Fig. 1 Is a front view of the double injection machine (4) showing the injection units (1) and (2), as well as the fixed (5) and rotating (6) plates respectively.

Fig. 2 Is a front view of the rotating plate (6) and of the fixed plate (5) showing the position where the parts of the turning parts of the mold (12) and (13) are placed

Fig. 3 Is a higher view of the injection machine (4) showing the rotating (6) and fixed (5) plates respectively, as well as of the two injection units (1) and (2).

Fig. 4 Is a perspective of the inferior part of the lid (18) showing the two orifices (14) and (15) where the terminals of the capacitor are riveted. These orifices cross the two parts of the lid from side to side, both the rigid part (17) and the rubber material part (18).

Fig. 5. Is a perspective of the upper part of the lid (17) which shows the gas exhaust safety valve (16) and the rubber material contour (3) that serves as perimetric packing in the case where it is assembled, as well as mechanic grip in order that both materials do not separate. We must mention that the valve (16) is formed by means of an orifice in the rigid part of the lid (17) and totally covered in the rubber material part of the piece (18).

Fig. 6 Is a perspective where one may observe the two components separately forming the lid, the rigid part serves as higher lid of the capacitor (17), the edge (7) that serves as mechanical grip to secure non-detachment of the two parts, the rubber material (18) part that serves as packing in the case where it is assembled, as well as safety valve for exhaust of gas in case of overheating.